REMARKS/ARGUMENTS

Reconsideration of the present application, as amended, is respectfully requested.

A. Status of the Claims

As a result of the present amendment, claims 1-13 are presented for continued prosecution. Claims 12 and 13 have been added by this amendment. Support for claim 12 can be found in claim 11, and support for claim 13 can be found in claim 8.

B. The Invention

The present invention, as defined by the amended claims, includes a method and apparatus for preventing or reducing wrinkle formation in a blank during deep drawing. In one the novel aspects of the invention, the force exerted on the downholder is relatively small at the beginning of the deep drawing process, and further control of the downholder occurs based on a predetermined thickness trend and/or a trend or critical value of the thickness trend. In another novel aspect of the invention, the apparatus includes a control provided with a means for storing a desired downholder opening trend (so), a downholder opening speed trend (vo) and/or a critical value derived therefrom, and the positioning means is controlled such that the downholder moves in agreement with the downholder opening trend (s_o), the downholder opening speed trend (v_o) and/or the critical value derived therefrom.

By considering the thickness trend of the edge of the blank, one of the advantages of the present invention is that the downholder force can be minimized thereby producing low frictional forces between the apparatus and the blank. Consequently, the apparatus of the invention can be operated at a relatively low force, with relatively low energy, and with a relatively light design. In addition, the low forces reduce the risk of forming cracks in the blank. As a result, a qualitatively inferior starting material can employed with a corresponding lower material cost, while still achieving a superior final product. Moreover, the present invention eliminates the need to previously determine the counterforce or to employ trial and error testing to determine a suitable beginning downholder force (see page 2, line 23 to page 3, line 27of the application).

C. Claims Rejections under 35 U.S.C. § 112

The Examiner rejected claims 1-11 stating that the claims reciting alternative and speculative terminology.

Applicants have amended claim 1 to recite "preventing or reducing" instead of "preventing, at least reducing". Also, the subject matter beginning with the phrase "for instance" has been deleted from claim 11, and presented as dependent claim 12. Still further, claim 11 has been amended to correct the dependency.

In addition to the rejections specified above, the Examiner stated that the use of "or" and the use of "and/or" renders the claims indefinite. Applicants respectfully disagree. According to MPEP § 2173.05(H)(II), "or" terminology is acceptable. In addition, it is believed that the phrase "and/or" is definite, and complies with the requirements of § 112 because this phrase clearly establishes that one or more of the elements are required. Applicants therefore respectfully submit that the use of "or" and the use of "and/or" is acceptable.

D. Claims Rejections under 35 U.S.C. § 103

Claims 1-4 and 7 had been rejected as been unpatentable over Anderson (U.S. 4,316,379) in view of Kergen (US 5,477,723).

Anderson had been cited to teach an apparatus wherein the blank holding force is initially set at a low value and is increased corresponding to the advance of the drawing punch. Kergen had been cited to teach an apparatus having a sensor which regulates the blank holding force. The Examiner stated that would be obvious to use the sensor of Kergen to control the blank holding force in the apparatus of Anderson.

1. Anderson and Kergen do not teach to suggest controlling the downholder on the basis of a predetermined thickness trend and/or a trend of critical value derived from the thickness trend

In order to maintain an obviousness rejection under 35 U.S.C. § 103(a), the differences between the claimed invention and prior art must be obvious to a person of ordinary skill in the art at the time the claim invention was made. Applicants respectfully submit that Anderson and Kergen do not teach to suggest controlling the downholder on

the basis of a predetermined thickness trend and/or a trend of critical value derived from the thickness trend as recited in claim 1.

As described, for example, on page 9, line 26 to page 10, line 10 of the present application, the predetermined thickness trend of claim 1 can be determined by measuring the downholder opening trend (s_o) shown in Figure 3. As shown in Figure 3, the downholder opening (s_o) initially has a substantially constant value (range I-II) and then gradually increases at a constant inclination (range II-III) corresponding to a constant downholder opening speed (v_o). At point III, the measured downholder opening trend s_o shows a bend which indicates wrinkle formation P. Thus, the predetermined thickness trend recited in claim 1 can be based on the range between I-III of Figure 3, before wrinkle formation P occurs.

Similarly, the downholder opening speed the (v_o) at which the downholder opening trend (s_o) changes may also be measured. The measured speed (v_o) can be employed to determined the downholder opening speed trend (s_o) (page 10, lines 20-25).

Anderson teaches an apparatus composed of downholder 46, die 52 and hydraulic cylinder 22. The force exerted on downholder 46 by hydraulic cylinder 22 is controlled by servovalve 30. As noted by the examiner, Figure 3 of Anderson teaches that the force imparted on the blank is initially low and increases as the blank is cut (col. 4, lines 43-48 of Anderson).

Anderson does not teach or suggest that the downholder is controlled on the basis of a predetermined thickness trend of the edge of the blank and/or a trend or critical value derived from the thickness trend as recited in claim 1 and illustrated in Figures 3-5 of the application. In fact, Anderson does not even mention that wrinkle formation of the product is a factor to consider, such as wrinkle area P in Figure 3 of the present application. Applicants therefore respectfully submit that Anderson does not teach or suggest the method of claim 1 which controls the downholder on the basis of a predetermined thickness trend and/or a trend of critical value derived from the thickness trend.

Kergen teaches an apparatus including a downholder 3, a position means 4,10 and die ring 2. A displacement sensor is provided to measure the distance between blank holder 3 and die 2 (col. 5, lines 1-5 of Kergen). Based on the distance measurement of

Kergen, a pressure command signal regulates the downholder force to a minimum value that is just necessary to prevent the development of crinkles.

Kergen does not teach or suggest controlling the downholder on the basis of a predetermined thickness trend of the edge of the blank and/or a trend or critical value derived from the thickness trend as recited on claim 1. Moreover, Kergen teaches away from the present invention, because Kergen explains that the distance between the dye and the blank holder increases as soon as crinkles appear (col. 5, lines 3-5 of Kergen). The control strategy of Kergen teaches away from the present inventions, and in fact will result in a downholder force that is larger than necessary, because Kergen neglects the thickness trend of the edge of the blank recited in claim 1. Thus, when using the apparatus of Kergen, every thickness increase would indicate to those in the art that wrinkle formation has begun to occur. Consequently, according to the teachings of Kergen, the downholder would be inaccurately controlled, during which not only wrinkles, but also the thickness increase of the blank edge would be suppressed which would lead to an unnecessary high downholder force. In contrast to the teachings of Kergen, Applicants have discovered that the drawbacks of Kergen can be preventing by considering the thickness trend of the edge of the blank and/or a trend or critical value derived therefrom as recited in claim 1 (see page 2, line 23 to page 3, line 7 of the present application).

Applicants therefore respectfully submit that Kergen does not teach or suggest controlling the downholder on the basis of predetermined thickness trend of the edge of the blank and/or a trend or critical value of the thickness trend as recited in claim 1. Moreover, Applicants respectfully submit that Kergen teaches away from considering the predetermined thickness trend and/or a trend or critical value derived from the thickness trend of claim 1. It is therefore believed that the differences between the claimed invention and the combination of the teachings of Anderson and Kergen are not obvious to a person of ordinary skill in the art at the time the claimed invention was made as required to maintain an obviousness rejection under 35 U.S.C. § 103(a).

2. Claims 5 and 6

Claims 5 and 6 had been rejected as been unpatentable over Anderson in view of Kergen and Cao (US 6,769,280). Cao had been cited to teach measuring a critical value during a testing session and simulating a critical value by means of a dynamic model of the blank and a deep drawing process.

The combination of Anderson, Kergen and Cao does not teach or suggest controlling the downholder on the basis of a predetermined thickness trend of the edge of the blank and/or a trend or a critical value derived from a thickness trend as recited in claim 1. Applicants therefore respectfully submit that claims 5 and 6 are patentable over the cited references taken alone or in combination.

E. Rejections under 35 U.S.C. § 102

Claims 8-11 had been rejected as been anticipated by Kergen. The teachings of Kergen have been summarized above.

In order to maintain an anticipation rejection under 35 U.S.C. § 102, the prior art must disclose each and every element of the rejected claims with sufficient clarity to prove its existence in the prior art. Applicants respectfully submit that Kergen does not anticipate claims 8-11.

Claim 8 recites that the apparatus comprises a control provided with a means for storing a desired downholder opening trend (s_o), a downholder opening speed trend (v_o) and/or a critical value derived therefrom, wherein the positioning means is controlled such that the movement of the downholder is based on the downholder opening trend (s_o), the downholder opening speed trend (v_o) and/or a critical value derived therefrom. For instance, as shown in Figure 3 of the present application and described on page 9, line 26 to page 10, line 10, the downholder opening trend (s_o) can be measured by determining the behavior of a product series with regard to the occurrence of wrinkle P. In a comparable manner, the downholder opening speed trend (v_o) at which the downholder opening trend (s_o) changes may also be measured. Such a measurement is shown in Figure 5 of the application and described on page 11, lines 20-27.

Kergen does not teach or suggest controlling the positioning means such that the movement of the downholder is in agreement with the stored downholder opening trend (s_o), the downholder opening trend speed (v_o) and/or a critical value derived therefrom as recited in claim 8. Applicants therefore respectfully submit that claims 8-11 are not anticipated by Kergen.

F. Fees

The four-month period for reply to the Office Action expired on September 10, 2006. Since September 10, 2006 was a Sunday, the four-month period was extended until Monday, September 11, 2006. This Response is therefore being filed within the four-month shortened statutory period for reply. A one-month extension of time is hereby requested and PTO 2038 is enclosed for the extension fee. No further fees are believed to be due. If, on the other hand, it is determined that further fees are due or any overpayment has been made, the Assistant Commissioner is hereby authorized to debit or credit such sum to Deposit Account No. 02-2275. Pursuant to 37 C.F.R. 1.136(a)(3), please treat this and any concurrent or future reply in this application that requires a petition for an extension of time for its timely submission as incorporating a petition for extension of time for the appropriate length of time. The fee associated therewith is to be charged to Deposit Account No. 02-2275.

G. Conclusion

In view of the actions taken and arguments presented, it is respectfully submitted that each and every one of the matters raised by the Examiner has been addressed by the present amendment and that the present application is now in condition for allowance.

An early and favorable action on the merits is earnestly solicited.

Respectfully submitted,

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